OHIO'S OWN

By ELBERT J. BOEBINGER

II. WLW's TRANSMITTER

MENTION was made in a previous article of WLW's remote transmitter, one of the first of its kind to be built which broadcasts with more power than any other.

WLW's transmitter, near Mason, Ohio, a small town 25 miles northeast of Cincinnati, is located in a sparsely populated farm district, an ideal location, for engineers have found it best to have the transmitter in a secluded spot because nearby buildings absorb some of the energy which is radiated from the antenna and thereby reduce the strength of the signal. Also, generators and other electrical equipment in the vicinity might set up electrical interference which plays havoc with program reception.

The station's control room is located at the studios and the program is sent from here to the transmitting station at Mason over a special cable in about the same manner that telephone messages are sent over a wire.

At the transmitting station radio energy is generated at the required frequency of 700 kilocycles and the signal is amplified to 500,000 watts. There are twenty 100,000-watt amplifying tubes used for this purpose. The power passing through these tubes is so great that cooling is necessary to prevent them from melting. This cooling is accomplished by circulating air and water through them. The water is cooled by spraying it into the air (see the accompanying photograph).

After the signal is amplified, a tuning unit takes the energy from the tubes to the huge vertical antenna. From this tower the signal goes out in all directions to the receiving sets in our homes.

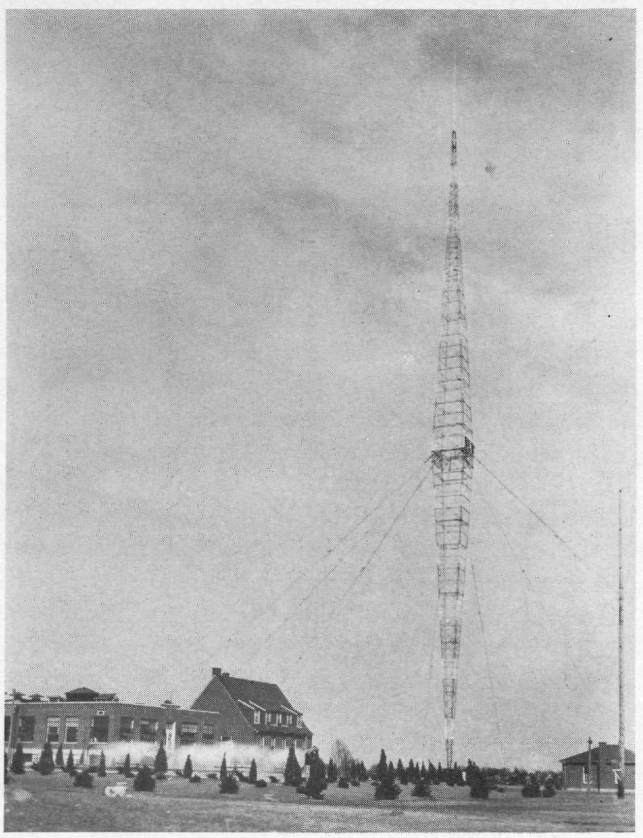
The antenna is vertical because it gives better wave radiation. It is 831 feet tall and contains 135 tons of structural steel. Due to the pull of the guy wires, which hold it rigid, and the weight of the tower itself, the total stress load at the base of the tower is 450 tons. This load rests on two porcelain pieces which are cup-like in shape with walls less than two inches thick. The purpose of this seemingly fragile base is to insulate the tower from the ground.

To provide a proper ground system for the transmitter tons of copper, including about six miles of heavy copper wire, were buried in the ground around the antenna. Heavy copper wires were used near the base of the tower to carry the high currents at this point.

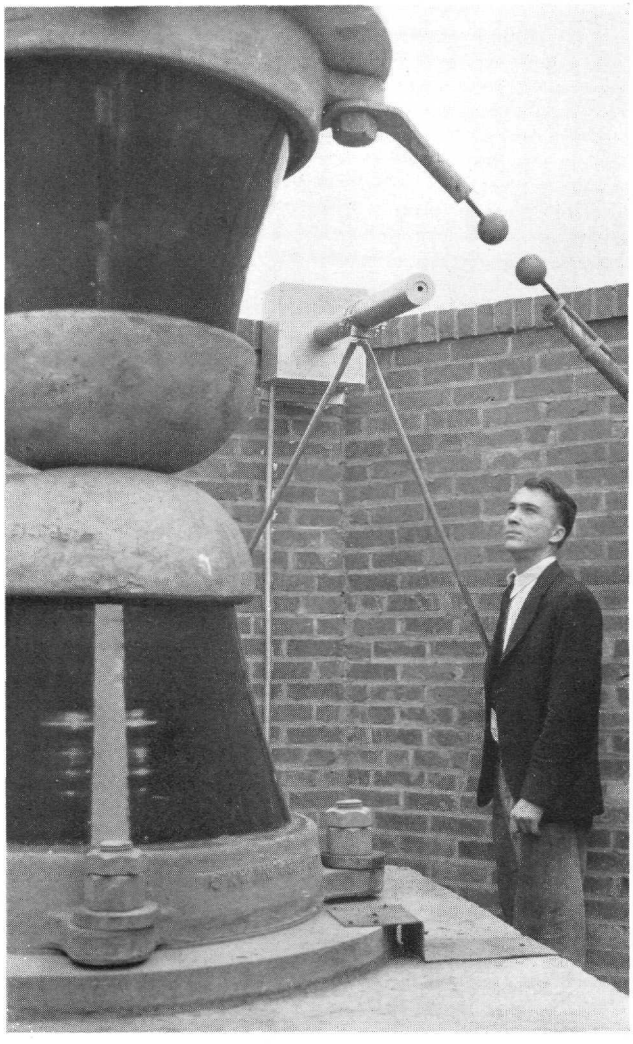
The vertical tower antenna increased the efficiency of the station about 50 per cent over the horizontal type, but it was soon discovered that unfortunately the huge steel tower also served admirably well as a giant lightning rod. It was found necessary to ground the electrical energy thus collected from the atmosphere while at the same time preventing the grounding of the 500,000 watts power generated by the transmitter. A direct lightning path was provided to the ground by means of a safety gap across the base of the tower. In adjusting the gap it was discovered that one wider than two inches failed to give complete protection while with one less than two inches the normal peak voltages due to the modulation on the power carrier would, on occasion, cause discharge across the gap.

An even more serious problem presented itself when it was found that once the arc was started across this gap, either by lightning discharge or by an abnormally high voltage, the arc could not be extinguished because the high power of the transmitter kept

TRANSMITTING STATION AND ANTENNA



BASE OF TOWER AND "ELECTRIC EYE"



it "alive," drawing practically all of the station's power from the antenna to the ground.

After various types of gaps, current transformers, and rectifiers were tried unsuccessfully, the use of the photo-electric cell device was resorted to. A Weston photronic cell, with its associated relays, was installed in a double shielded box on the brick wall surrounding the base of the antenna. A long tube containing light baffles was installed so that only light from a point directly in the safety gap could strike the photo-electric cell. The relay operated by the "electric eye" was connected in such a manner as to remove the station's plate voltage to the final amplifier whenever the photo-electric cell is excited and to reapply it the instant the arc is extinguished. Due to the high speed of the control circuits, the interruption to service is so slight as to be barely perceptible to the ear.

The frontispiece shows a typical "power follow-up arc" with the photo-electric arc extinguisher (in the background) disconnected. With the extinguisher in operation such power follow-up is prevented and the discharge becomes but an instantaneous flash, after which the transmitter continues normal operation.

There are two suppressor towers in the vicinity of the antenna which were built to shield radio waves in the direction of Toronto, Canada. Station CFRB of that city, operating on a frequency near that of WLW, complained that they were being blanketed out. This method was found to be the easiest way to solve the problem.

The cost of electricity to operate the transmitter each month is approximately $8000. Each of the 100,000 watt tubes cost $1650. This will give you a rough idea of some of the expense connected with the operation of a transmitter of this size.